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CIVIL RESERVE INFORMATION SERVICES (CRIS) CONCEPTS AND ONE POSSIBLE SOLUTION

BY

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CIVIL RESERVE INFORMATION SERVICES (CRIS) CONCEPTS AND ONE POSSIBLE SOLUTION

AN INDIVIDUAL STUDY PROJECT

by

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ABSTRACT

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INTRODUCTION

BACKGROUND

One of the communications lessons we keep relearning, and that was highlighted during the Gulf War, is that there is never enough communications or information systems to satisfy every commander's needs. Lack of communications systems and signal capacity has been a major item in every after action report since Grenada. In every case, the follow-on recommendations are always the same--increase the communications available to the commanders from four star level on down. But increasing communications requires an outlay of money and manpower that is not readily available now, and will be even scarcer in the next ten years. In the future, providing worldwide communications to commanders within a theater of operation will require a different approach than the Department of Defense (DOD) is now using so that money and manpower can be conserved. This future approach must decrease the need for military-unique strategic communication systems and the soldiers necessary to operate them. This approach will also require DOD to rely heavily on readily available civilian communication and information systems to augment our already stressed military systems.

THE CRIS CONCEPT

A concept that could satisfy future military communication and information systems needs by increasing civilian involvement could be modelled after the successful Civil Reserve Air Fleet (CRAF) program, administered by the Military Airlift Command (MAC). This new concept could be called the Civil Reserve

Information Services (CRIS).[1] A well established CRIS program could provide the needed communication and information systems augmentation that the commanders have been demanding. The CRIS program could respond to crisis situations, up to and including a declared national emergency or war, to satisfy the switching, satellite, cable and information systems requirements of an overseas theater of operations.

IMPLEMENTATION OF CRIS

LEGAL CONSIDERATIONS

For CRIS to be a viable program, the Secretary of Defense must be made, by law, specifically responsible for developing plans to augment, during national emergencies, the existing DOD systems with civilian communication and information systems. Without the authority of the law backing it, the managers of the CRIS program will not have the power to immediately task federal agencies or expend funds to meet the timely operational requirements of the military commanders. An easy approach, to insuring legal approval of the CRIS program, would be to supplement existing laws. For example, the CRIS program could be added as an augmentation to the existing Telecommunications Service Priority (TSP) directive. The TSP is an Executive Order of the President (Directive 3-1), November 1988, requiring the FCC to establish a regulatory, administrative and operational system that would authorize priority treatment for

telecommunications services for national security emergencies.[2] Another approach could be to amend Executive Order 12472 (3 April 1984). This executive order delineates the mission of the National Communications System (NCS). The NCS's purpose is to assist the President in administrating wartime and non-wartime emergency telecommunications, in particular those telecommunications involved in national security during crisis, attack, recovery and reconstruction.[3] An amendment to either one of the above executive orders for the purpose of including the CRIS program would not be precedent setting. For example, Executive Order 11490, making the Secretary of Transportation responsible for the CRAF program, has been amended many times to accommodate operational and policy changes that have occurred since its establishment forty-one years ago.[4] The same can be done with the two executive orders to make the CRIS program an integral part of a binding law. This method would be much easier than creating a completely new law or executive order.

TASKING AND POLICY CONSIDERATIONS

Though both executive orders could be amended, the amendment of Executive Order 12472 to include the CRIS program as part of the NCS offers the best approach to solving the responsibility and tasking structure that will be required to make the CRIS program a success.

Executive Order 12472 established the current mission of the National Communications System (NCS). The NCS's purpose is to assist The President, The National Security Council, The Office

Of Science and Technology Policy and The Office Of Management and Budget in the coordination for, and provision of, national security and emergency preparedness communications for the Federal Government.[5] As part of its charter, the Office of Science and Technology Policy (OSTP) monitors the policy actions of the NCS and could also direct the national level policy of the CRIS program (see Figure 1). Because OSTP resides in the Executive Office of the President (EOP), access to presidential policy decisions concerning CRIS implementation would be streamlined. In this configuration, the DOD would not be excluded from the decision process but would have input through its representative on the Joint Tasking and Requirements Board (JTRB) which acts as an advisory board to OSTP. Under the proposed scheme, this same DOD representative would likely be a member of the National Coordinating Center (NCC). The NCC was created at the same time as the NCS and coordinates the internal daily schedule of the NCS. If implemented in this method, the CRIS program would have the legal status already provided the NCS by Executive Order 12472. As an added bonus, the CRIS tasking and policy decision chain would be a simple three step operation during crisis action planning. In the first step, NCS would provide to the OSTP, through the JTRB, a national overview of all available civilian and military communication and information systems that could assist in the crisis. The JTRB would then screen the input and advise the OSTP on the best options, with the DOD representative providing input at this time. In the last

step, OSTP would provide The President with decision options on how best to implement the CRIS program.

EXECUTION CONSIDERATIONS

Once this chain of control and authority has been established for the CRIS program under the bigger structure of the NCS and by Executive Order 12472, then the Secretary of Defense can be tasked to implement the CRIS program. In turn, he can give the authority for operational tasking to the Defense Information System Agency (DISA) which resides under his direct control.

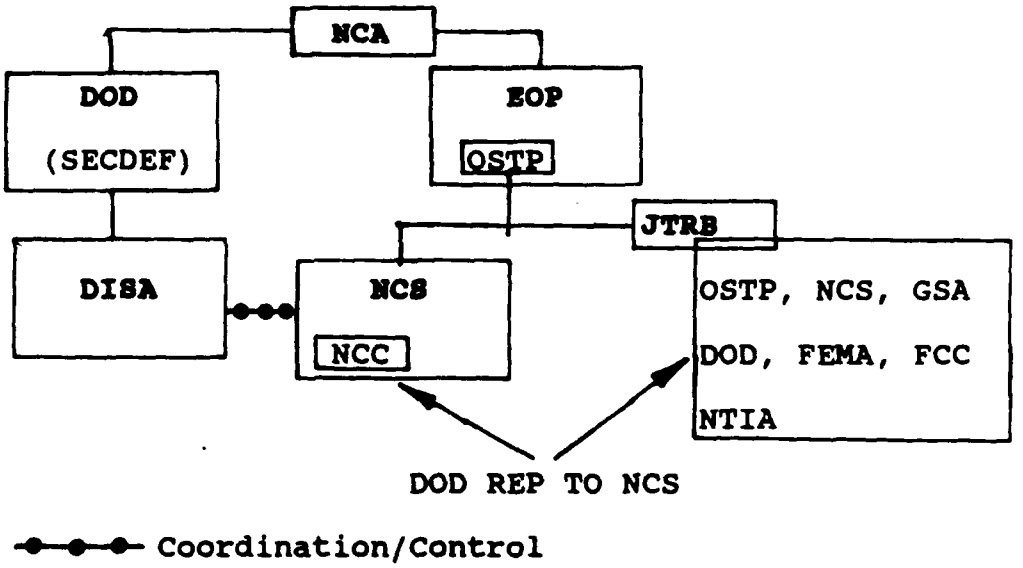

Figure 1. Tasking and Policy Relationships

Fortunately, DISA is already organized to handle the operational tasking that would come with the CRIS program. The Defense Communications Agency was established by direction of the Secretary of Defense in 1960 and was renamed the Defense Information Systems Agency (DISA) by DOD Directive in 1991.[6] It is a combat support agency of the DOD under the direction,

authority, and control of the Assistant Secretary of Defense, C3I.[7] DISA has many missions, but four standout as being directly applicable to the CRIS program and they are: guarantee the end-to-end employment and operations of strategic and tactical communication and information systems used by the National Command Authority and Commanders-in-Chief of the Unified and Specified Commands (CINCs), through the development and maintenance of joint architectures, standards, and the testing of hardware and procedures; acquire commercial information systems services (e.g., long-haul C3 circuits, facilities, networks, and associated equipment) for the Department of Defense as directed; execute tasks as Manager of the National Communications System (NCS) as may be assigned by law or directed by the Secretary of Defense; and support national security emergency preparedness telecommunications functions of the National Communications System as prescribed by Executive Order 12472.[8] By taking the amendment approach to Executive Order 12472, the CRIS program could be linked to the DOD through the existing mission requirements of DISA via the NCS and the directional authority of the Secretary of Defense. The wording of the amendment to Executive Order 12472 would stipulate the detailed role of the Secretary of Defense in executing the CRIS program and give him the power to execute it within the law.

OPERATIONAL CONTROL OF CRIS

Once the CRIS program is established by law and the authority chain of command solidified, then the operational

structure and the mission of the CRIS program can be easily developed along the same lines as the CRAF program.[9] Currently, the CRAF program identifies, organizes and develops a source of civil airlift that can be made available to augment DOD requirements. CRIS would do the same for civil information systems and make these systems available to augment military communication and information services.

To make the operational structure of the CRAF program easier, it is implemented in stages. Each stage increases the airlift requirement demanded by DOD and in turn requires a higher level of authorization to activate these stages. The CRIS program could use these CRAF stages as a model. For example, CRIS Stage I might be a controlled expansion of global information capability in preparation for a military operation. The authority for this stage would come from the Director of DISA. The Secretary of Defense would be informed by message of the expansion and coordination would be conducted with the National Communications System (NCS) to activate the additional capacity.

Stage II of CRIS might be an information emergency short of national mobilization. Authority to activate Stage II would come from the Secretary of Defense. DISA would take action upon receipt of authority from the Secretary of Defense and would coordinate follow-on actions with NCS, CINCs and Major Commands.

The final stage of CRIS, Stage III, might be activated in the case of a national emergency. The Secretary of Defense would

issue the orders when given the authority by the President. Stage III would be the highest level and the most demanding on civilian information systems. At Stage III, either war would be declared or there would be a non-defense, national level emergency. Developing the stages of CRIS is relatively easy but managing them will be a complex task that will require a dedicated command structure.

The command structure required to manage the CRIS program exists today in DISA. DISA is a major combat support agency under the control of the Secretary of Defense. More importantly, DISA is presently tasked to provide military strategic information services to CINCs and worldwide Major Commands. The CRIS program requirements could be blended into the already developed communication and information structure of DISA. The Director of DISA, similar to the Commander of MAC for the CRAF program, would be designated the Executive Director and sole manager for information services. As the single manager, the Director of DISA would act upon requests directly from the CINCs for civil information services necessary to augment existing military communications. This would be a much more direct tasking route than is presently being used. Today, requests for civilian communications services can be initiated separately by the Services, DISA, CINCs, or the United States Army Information Systems Command (ISC) without regard to the total communications or information services requirements within a theater of operation.[10] Conflicts in priority and utilization of assets can

easily occur in this type of multi-tasking environment when a sole focal point for coordination is not established by doctrine.

It makes sense to give one command the responsibility for the civil information service augmentation of military communications. With DISA as that command, it can be responsible for the identification, organization and development of sources for augmentation civil information systems. In fact, DISA's mission already makes it responsible for acquiring commercial information systems services but unfortunately not to the extent the CRIS program would demand.[11] DISA could also provide operation, management, engineering and integration support for these civil systems within the scope of its existing command structure.

Identification and establishment of operational requirements for CRIS would be a major part of DISA's responsibility. This development of operational doctrine would insure that the proper interface with evolving DISA telecommunications networks would be a coordinated effort, and that future requirements of the CINCs and Major Commands would be met. Additionally, DISA could merge this CRIS doctrine with the guidance it already receives from the Chairman of the Joint Chiefs of Staff on military and communications doctrine, operational policies, requirements and procedures.

One of the more difficult tasks of the CRIS program will be the tracking of information technology advancements. One of DISA's mission, under the CRIS program, would be to establish

direct coordination with civil information systems companies for the purpose of seeking voluntary inclusion into the CRIS program. Fortunately, DISA already has a field organization, the Defense Commercial Communications Office, that deals directly with the civilian communications world.[12] With this already established link to the civilian world of information systems, plus the stated mission to acquire commercial information services for the Department of Defense, DISA would be naturally positioned to implement the operational requirements of the CRIS program. Not only could DISA track the latest communication and information systems developments but it would be, as it is now, authorized to contract for these civilian services. DISA is the logical one stop, single manager organization within the DOD to coordinate a national program like CRIS.

A VOLUNTARY PROGRAM

A CRIS program will not be the answer to all the future communications and information problems the military will face. It is a program that is designed to be activated only when a critical need to augment Defense systems exists. The program will fill the gap between day-to-day requirements and surge requirements needed during a crisis. For example, as in the CRAF program, the day-to-day military airlift requirements are handled by Air Force aircraft. Only during a committed expansion beyond the capabilities of the Military Airlift Command is CRAF activated. The CRIS program will be similar. During non-crisis periods, civilian communication and information services will be

identified, organized and developed under the CRIS program. These services will be tailored so they can quickly augment the DOD in a national emergency. Because the CRIS program will be voluntary, companies will need encouragement to participate. For those who decide to be part of the CRIS program, the incentives offered must make good business sense. For example, companies that participate in the program could receive special contractual preference to handle routine, peacetime DOD communication and information requirements or be put on retainer much like a big business does a law firm. Additionally, any monies needed for modifications to a civilian system, to make it more compatible to DOD requirements, would be paid by the government. In the CRAF program, the government paid for the installation of large cargo doors on some civilian aircraft to meet unique military requirements. The same approach could be used for the CRIS program, if for example, military encryption devices and standards were necessary on some of the civilian systems. To make it work, the CRIS program must be seen as mutually advantageous to both the DOD and the civilian companies. In the future, it will require a team effort to provide augmentation communication and information support to the United States during an emergency. A team effort, using the CRIS concept, that could also payoff with savings in military manpower and defense dollars.

CRIS AND AIRLAND OPERATIONS

DOCTRINAL CONSIDERATIONS-UNITED STATES

Up until now the CRIS program has been examined in the broad sense. The following discussions about the CRIS program will be more focused and will include; identifying communication issues inherent in AirLand Operations concepts, reviewing NATO's approach to overhauling their C3I, and investigating a future commercial communications system that could be a likely candidate for the CRIS program.

The new AirLand Operations concept changes the perspective of how the Signal Corps looks at the battlefield. The lineal front of the AirLand Battle Doctrine, with corps tied in right and left, allowed signal systems to fit nicely into predesignated grid squares. Now, the AirLand Operations concept presents the new challenge of movable footprints of operation (see Figure 2).[13] The battlefield of the future will be expected to expand and contract to accommodate the enemies' actions. The military forces will require C3 robustness within and between these operational footprints to provide the commanders the communications they will need. These goals can only be accomplished if the military can make the best use of investments in current communication and information systems while at the same time exploiting future commercial technologies. Some of the future C3 challenges will be: to keep up with the movable operational footprints, to provide C3 long haul

connectivity between footprints and CONUS based support facilities and to provide alternate and redundant communications.[14] Unless a new technology is invented, Airland Operations will rely heavily on satellites to tie all these footprints together. Logically, in this environment, the overall demand for satellite communication devices will increase, followed closely by demands for smaller and highly mobile configurations. As always, there will be an institutional requirement for total integration of any new systems with the older ones.

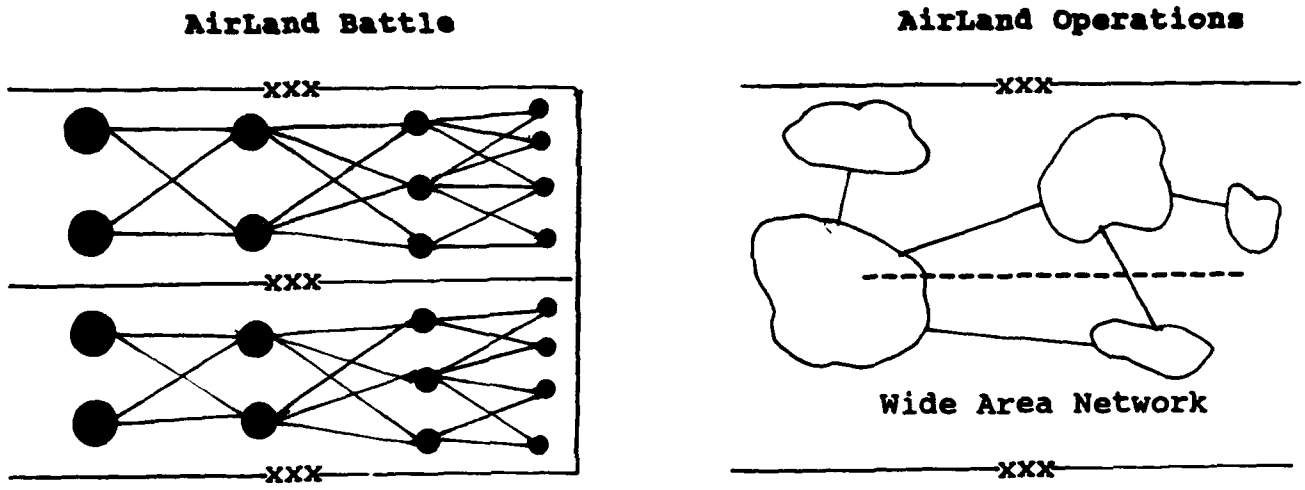

Figure 2. C3 Coverage AirLand Battle Compared to AirLand Operations.[15]

DOCTRINAL CONSIDERATIONS-NATO AND U.S. ARMY

The AirLand Operations doctrinal problems facing the Signal Corps are becoming evident in Europe today. In the past, NATO

fighting doctrine was focused on the Soviet Union. A doctrine that assumed that the battles would be fought along clearly defined corps and division boundaries. Today that doctrine no longer applies. As NATO restructures to meet the realities of the post-Soviet Union, the old approach to C3I is also being overhauled. Brig. General Paul Schodts, deputy assistant director of communications and information systems with NATO's international military staff recently said, "We need very many more mobile satellite terminals. It's a high priority."[16] Additionally, NATO has become more interested in existing commercial communications systems and equipment, particularly commercial satellite systems.[17] This point was highlighted by Lt. Gen. John T Myers, deputy director of NATO's Communications and Information Systems Agency, when he said, "We're not going to buy commercial, off-the-shelf equipment just because we're poor, but because it's good."[18] Not only will NATO be buying commercial equipment but it will be leasing equipment and services to augment the existing military C3I structure. At a recent Armed Forces Communications and Electronics Association conference in Belgium, Rear Adm. Sigurd Hess, top communications expert at NATO headquarters, told the conference that future NATO military communications in peacetime should rely primarily on leasing services from commercial phone and satellite companies of the member nations.[19] NATO is seeking commercial communications that can rapidly build up during a crisis and also offer redundancy to existing NATO communications systems. This type of

communications will be necessary to support the integrated, highly mobile, crisis reaction force of post-Cold War NATO.

The Army has, like NATO, seen the need for better communications at the crisis level. The Army Signal Corps has plans to create communications packages to support crisis operations. The first of these packages is called the Contingency Communications Package (CCP).[20] Some of its operational requirements will be: to provide communications and automation to support two task force headquarters and two subordinate brigade command posts, to be transported in two or less air sorties per CCP, and to provide area coverage for static and mobile subscribers while allowing for expandable communications.[21] In creating the CCPs, the Signal Corps is trying to achieve an increase in operational flexibility, a sustainable C3 force and a reduction in air sortie requirements. As in NATO's future C3I restructuring, satellite communications in both multichannel and single channel configurations will play a big part in providing critical communication links between the deployed CCPs and CONUS.

DESERT STORM EXPERIENCES

Operation Desert Storm has presented recent examples of communication shortfalls that illustrate the need for doctrinal change. The fast pace of the operations and the area over which they were conducted, presented a problem for Desert Storm communicators. The Signal Corps had trained and equipped its forces to meet the needs of AirLand Battle Doctrine. The type of

warfare the United States military conducted in Desert Storm was more like the warfare that is predicted to be fought under the new AirLand Operations concept. In Desert Storm, the units within the movable C3 footprints had additional requirements for intra-connectivity as well as non-doctrinal requirements for C3 extensions to CONUS based support elements. Because these communications systems could not keep up with the pace of battle nor span the distances involved; command, control and operations were negatively affected.[22] This degradation was apparent with both organic and external communications systems. Organic VHF, line-of-sight, radio systems and HF radio systems could not communicate over the large maneuver areas.[23] External communications provided by supporting signal units were not able to keep up with the attacking forces. Set-up and tear-down times restricted these units from providing constant service, while the geographical dispersion of the combat units reduced the built-in redundancy of the pre-planned AirLand Battle doctrinal networks.[24] In the end, the signal units were usually playing catch-up to the maneuver forces, hoping that the pace would slow so that the entire communications network could be established per doctrine. The recommendations resulting from these issues are predictable. Communications systems must be downsized to improve their mobility and signal units must maintain the same operational tempo as the units they support.[25] Additionally, communications equipment must meet the unique operational requirements of each unit. Possibly, this is a situation where

the CRIS program could help. Temporarily tailoring the communications needs of individual units, especially long range communications equipment, could conceivably be solved by the introduction of a CRIS program into the DOD structure. For example, the CRIS program could provide a combat or logistic unit, which would not normally have satellite equipment on its TOE, with augmented civilian satellite support. This augmented system would travel over civilian satellites circuits and not compete with already allocated military assets.

CRIS REQUIREMENTS-SUMMARY

A short compilation of the requirements as presented in the above examples will be useful in looking for ways to solve future communications problems.

In AirLand Operations, the military will require operations and communications to be conducted within mobile footprints. There will be a requirement for robustness and redundancy in any of the systems used. Long haul communications between operational footprints and with CONUS base support facilities will be a must. Additionally, there will be a heavy reliance on satellite communications as well as a need for total integration of new, leased or bought systems into existing communication systems.

NATO's future communications requirements will center around highly mobile satellite communication systems. They will seek commercial leasing and buying options to support the augmentation to existing military communication systems.

The U.S. Army Signal Corps will support future war fighting doctrine with small mobile systems. These systems will require minimum airlift and must provide worldwide coverage, i.e. some form of satellite communications. The worldwide coverage aspect of these systems will become especially critical as the U.S. Army moves to a more CONUS based contingency force.

Finally, Desert Storm taught the military that future communications support must be able to keep pace with operational units. Communications equipment must provide extremely wide-area coverage and not require an operational commander to stop maneuvering in order to establish command and control communication links.

In the above examples, there exists some commonality of requirements. It will be important to satisfy these future communications requirements, but the lack of dollars and manpower may make it nearly impossible. However, a viable CRIS program could help alleviate some of the manpower and dollar problems and still provide the needed communication and information services.

CRIS IN CONTINGENCY OPERATIONS

THE IRIDIUM CONCEPT-POTENTIAL APPLICATION

Today, there are many companies that have much to offer in support of a CRIS program. Very recently, during Desert Storm, many of these communication and information companies augmented overloaded military systems with their own equipment. Their

support was one of the success stories of Operation Desert Storm. Now, DOD needs to capitalize on this success and insure their support in the future by creating a CRIS program. As an example, of how this can be accomplished, and not as an endorsement for any particular system, Motorola's Iridium system will be investigated to see if it could be a candidate for a future CRIS program.

The Iridium System is designed as a worldwide digital, satellite-based, cellular communications system. The ground based, hand-held, communications terminals will be linked through a constellation of small, low Earth orbiting satellites. The entire system will provide unrestrained, point-to-point communications between users anywhere on the earth's surface.[26] The Iridium System will be able to support voice communication, facsimile and data transmission worldwide when it becomes fully operational in 1997.[27]

The goal of the Iridium System will be to connect individuals worldwide using pocket-sized telephones. These telephones will, in fact, be a personal communications device with worldwide access. This concept of personal, mobile communications has been changing quickly throughout the 1980s. Car radio telephones freed people from the home or office telephone, though the range and quality was limited. Later technological developments led to cordless telephones in the home. This technology gave people more freedom of movement but very limited range. The mid-eighties saw an explosion in the

cellular car telephone. The cellular telephone gave people mobile, personal communications and worldwide access as long as they stayed within the cell's range. The Iridium concept has taken this cellular telephone concept a step farther.

In the Iridium System, the user becomes the relatively stationary part of the system and the satellite based cells move over the earth surface above him. This is just the opposite of the present terrestrial cellular telephone system. The satellites will be in low, polar, Earth orbit at 413.5 nautical miles with 11 satellites in each of the seven orbital planes (s Figure 3).[28]

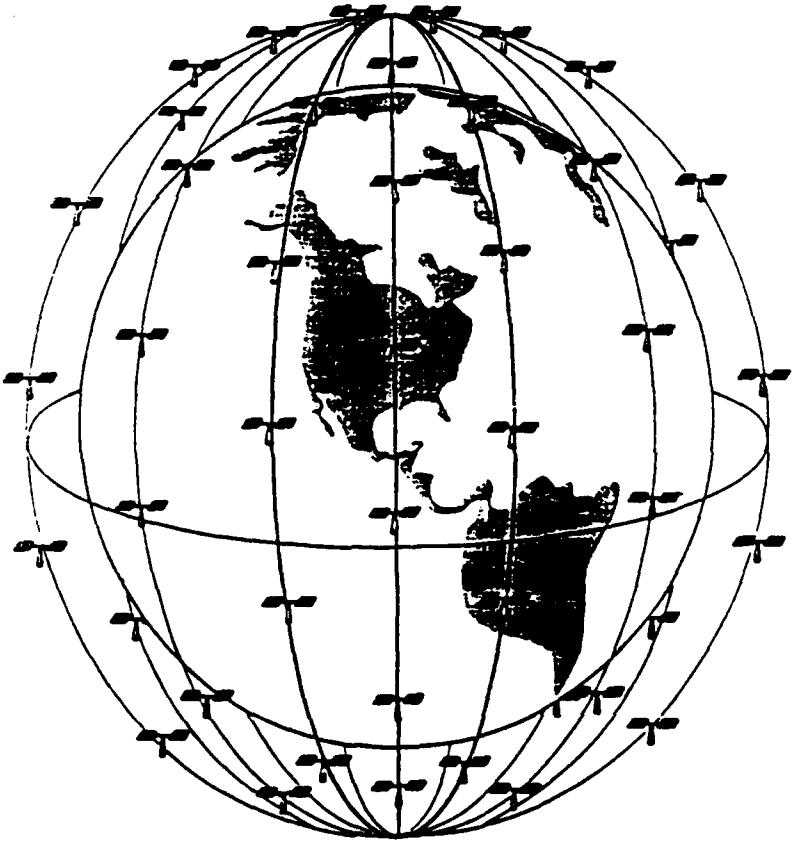

Figure 3. Iridium Constellation[29]

The low orbits of the 77 satellites are the key to the Iridium System concept. Because of the low orbits, the transmitter power from the handheld cellular telephones can be kept at a low level without driving signal path losses to unacceptable levels. This all equates to a very small design package for the telephone device.[30] Each satellite will control 37 cells as it moves through orbit and each cell will cover an area of approximately 360 nautical miles in diameter on the face of the earth.[31] This type of coverage converts to approximately 110 simultaneous users per cell.[32]

A CONTINGENCY ILLUSTRATION

Iridium would be a very limited system if it could only link with special telephones but Motorola has solved this problem. The first iteration of Iridium will incorporate about 20 Earth-based gateways that will provide access into the Public Switched Telephone Network (PSTN).[33] These gateways will receive the crosslink signals from the user's telephone and then pass it through the PSTN where the connection will be made to a standard telephone in a home or office. As an illustration, imagine a soldier in the middle of the Sahara Desert (see Figure 4). He is in the lead element of a joint task force. He reaches into his backpack and pulls out the two pound, hand-held, Iridium telephone issued to him before the mission. He dials the long distant telephone number for his command at Fort Bragg, North Carolina. The telephone sends the signal up to the satellite in whose cell he is located, then this satellite crosslinks to four

adjacent satellites west of the soldier's position. The fourth satellite downlinks to the east coast gateway and the gateway passes the signal off to the local PSTN. The PSTN makes the connection to the telephone on the commander's desk in the war room. This may seem like a complicated and time consuming process, but normal delay times for interconnecting any two points on the Earth will take less than 150 milliseconds.[34] The Iridium system becomes less complicated had the soldier wanted to talk to his forward scout element located 100 kilometers to the south. In this instance, the signal would have been processed by only one satellite and would have stayed within that satellite's own cell coverage.

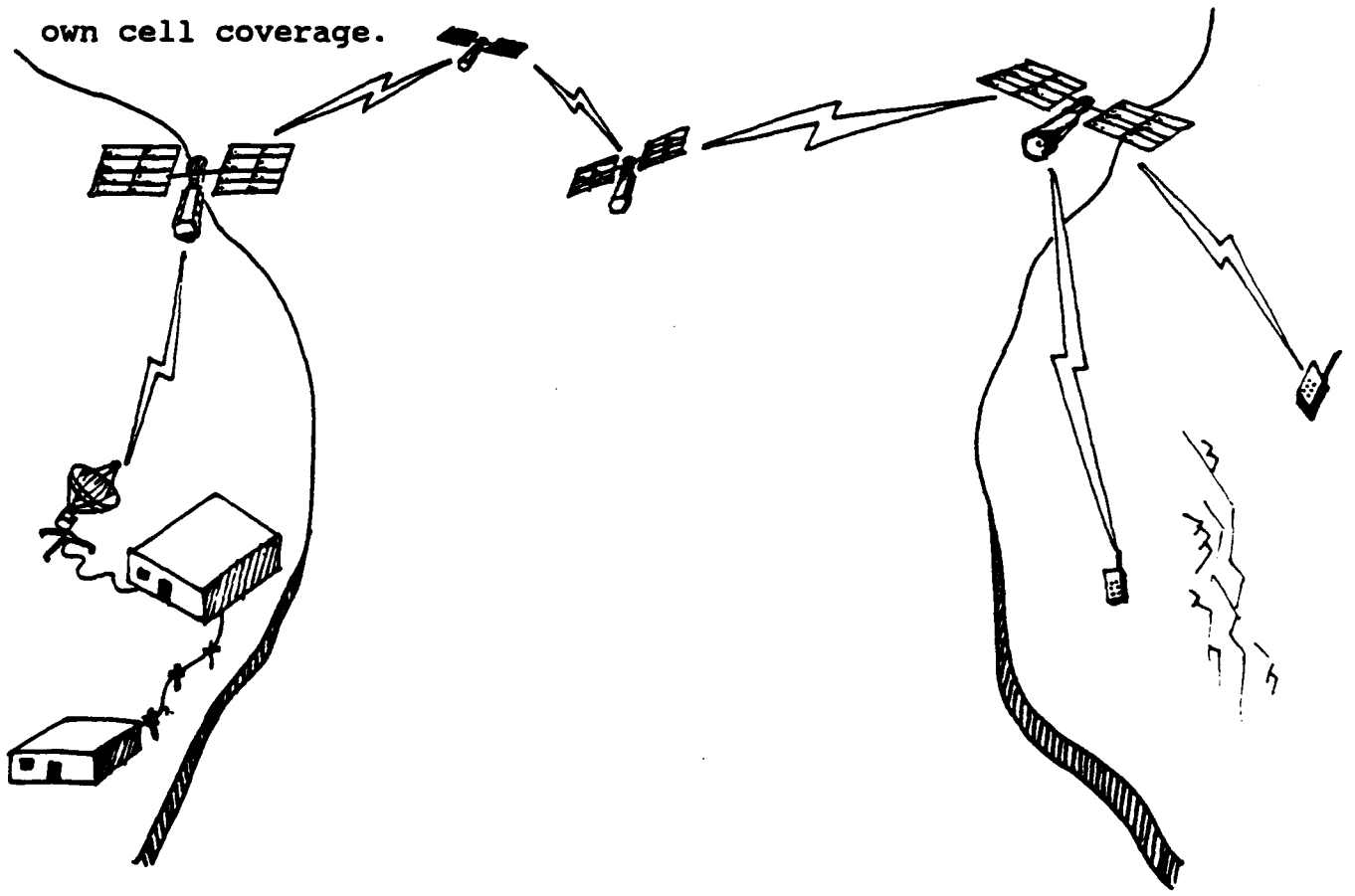

Figure 4. Iridium System Overview-Military[35]

The illustration points out how Iridium can be used for strategic and tactical communications, but is it or systems like it really a good all around candidate for the CRIS program? To find out, a closer look at what the concept has to offer in augmenting defense systems is necessary. Iridium and systems like it will be worldwide systems. Their personal communication devices will be handheld size. The infrastructure (satellites, gateways) will be civilian maintained. Operationally, the space based portion will differ in orbit and communication frequency from current military, geostationary, communication satellites. This difference would give diversity, robustness and redundancy to commanders using both military and Iridium type systems. Iridium or systems like it will integrate with the present public telephone system. The Iridium concept will provide digital voice transmission, facsimile, data transmission, geopositioning and global paging. Operation of the Iridium system will be from land or water as well as from aircraft flying below 30.48 kilometers.[36] Best of all the Iridium concept will not require the user to stop to put the system into operations. It will be a totally mobile system. Unfortunately, Iridium type systems will have limitations in the quantity of calls that can be transmitted and received from a cell. For that reason, these systems could best be used to augment military systems at the beginning and end of any operation where the total communication demands are usually at low to medium levels but manpower, size and mobility are at a premium.

The Iridium system and the concepts it encompasses look like an invaluable means of communications, not for just a military crisis, but also for natural emergency situations such as floods or earthquakes. Without any changes, the Iridium concept could satisfy most of the communication needs of current government and law enforcement officials. However, if Iridium or systems like it are to be considered as an augmentation to government or DOD communications certain modifications and technical parameters must be met during the development stages of the system. These pre-launch modifications could prevent costly rework of the entire system and illustrate why DOD must become involved with potential CRIS companies early in their development of new communication and information systems. Specifically, the Iridium system must be able to pass STU III encrypted traffic. The handheld devices must be STU III capable. Additionally, in the United States, the Iridium gateways must be capable of linking directly into the Department of Defense's communication networks. As a option, the Department of Defen e could request its own unique gateway. If Motorola or any company with a similar system to Iridium were to volunteer for the CRIS program, the Government could pay for these special features just like it did to modify civilian aircraft for special cargo and medevac purposes in the CRAF program. Possibly, government contracts for day-to-day use of the Iridium system could motivate Motorola to be a voluntary participant in the CRIS program. Motorola could already be thinking along this line because it is projecting that 16% of

Iridium's market will be government subscribers by the year 2001.[37] Though the CRIS program and the Iridium system are not in existence at this time, the realization of their concepts would be a powerful augmentation to future defense communications.

CONCLUSION

THE FUTURE FOR CRIS

As the military downsizes, our strategy to plan and execute information services support for a theater of operations must not diminish. The Army Plan under Long-Range Perspective, Modernization, states, "The Army must assess the military significance and potential of spin-offs from emerging technologies and integrate their use in future doctrine, force design and acquisition programs. Our future depends on resourcing a robust and innovative technology base...".[38] A program like CRIS can provide the integration and augmentation to existing military information services and exploit new commercial technologies like Iridium at the same time. In this period of budget constraints, the DOD can not afford the costs in dollars or manpower to develop the information systems that are available through contractual services with civil companies. The CRIS program is a cost effective way of receiving the additional strategic and theater information services needed today and in the future.

ENDNOTES

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30. Sterling and Hatlelid, 1.

31. Bertiger, Swan and Leopold, 41.

32. Motorola, 8.

33. Bertiger, Swan and Leopold, 42.

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